

TIER 1

**UNDERGROUND INJECTION CONTROL
PERMIT APPLICATION**

Ute Tribal # 31-04
770' FNL & 703' FWL
Sec. 31, T5S-R3W
Duchesne County, Utah
API # 43-013-32034

July 2015

Prepared for:
Bruce Suchomel
Groundwater Program, Mail Code 8P-W-UIC
U.S. Environmental Protection Agency
1595 Wynkoop St
Denver, CO 80202-1129

Prepared by:
Petroglyph Energy, INC.
960 Broadway Avenue, Suite 500, P.O. Box 70019
Boise, Idaho 83707
(208) 685-7600
FAX (208) 685-7605

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UNDERGROUND INJECTION CONTROL
PERMIT APPLICATION

- DEVIATION LOGS
- SUNDRY REPORTS
- CBLs FOR AOR WE
- HOW WAS USDW DETE

31-04

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LIST OF ATTACHMENTS

- | | |
|-------------------|---|
| Attachment No. 1 | Area Topography Map |
| Attachment No. 2 | Site Map |
| Attachment No. 3 | Map of the A-Marker surface |
| Attachment No. 4 | Cross-Sections of the injection formation |
| Attachment No. 5 | Water Analysis |
| Attachment No. 6 | Completion data for all wells in the AOR |
| Attachment No. 7 | CBL for the UIC well |
| Attachment No. 8 | Open hole log for the UIC well |
| Attachment No. 9 | List of owners and Affidavit Notification |
| Attachment No. 10 | Well bore diagrams for the UIC well |
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**SUMMARY DOCUMENT
UIC WELL APPLICATION
Ute Tribal 31-04
API # 43-013-32034**

The following document contains information provided in support of the application for the conversion of the Ute Tribal 31-04 well to an injection well in the Green River formation in the Antelope Creek Field in Duchesne County, Utah.

The Antelope Creek Field falls within the Uintah and Ouray Indian reservations and is within Indian Country; therefore, for facilities located on the reservation, only EPA-issued UIC permits are necessary for compliance with UIC regulations.

The EPA has issued an Area Permit #UT20736-00000 for the Underground Injection Control for the Antelope Creek Field. This area permit allows for additional producing wells to be converted to injection wells for enhanced recovery.

- (1) Petroglyph Energy, Inc. (Petroglyph) is the operator and only working interest owner of wells located in the Antelope creek Field, Duchesne County, Utah. Petroglyph's business address is provided below:

Petroglyph Energy, Inc.
960 Broadway Avenue, Suite 500
P.O. Box 70019
Boise, ID 83707

- (2) Enclosed as Attachment No. 1 is a topographic map of a portion of the Antelope Creek Field, identifying all wells located in this area. The legal location for the Ute Tribal 31-04 is 770' FNL & 703' FWL NW/NW Sec. 31, T5S-R3W.
- (3) Attachment No. 2 is a map of the well. This map shows a circle with a ¼ mile radius centered on the Ute Tribal 31-04 well. The ¼ mile radius encompasses the area of review, AOR, within which Petroglyph is required to investigate all wells for mechanical integrity. The ¼ mile radius also identifies mineral ownership; those lands, and the the owners thereof, which must be provided notice of this application. The AOR has Ute Tribal 30-13, Ute Tribal 30-14N, and Ute Tribal 31-05 well(s) located in its ¼ mile radius.

- (4) Petroglyph proposes to utilize the Ute Tribal 31-04 as an injection well for enhanced recovery in the Antelope Creek Field.
- (5) Injection Zone – The injection intervals are between 3456' and 5432' True Vertical Depth and located in the lower portion of the Green River Formation. The injection zone is confined within a 1976' section between the Green River "A" Lime marker bed and the top of the Basal Carbonate in the lower part of the formation. The injection zone is composed of lenticular calcareous sandstones interbedded with low permeable carbonates and calcareous shales. The lenticular sandstones vary in thickness from 1 to 30 feet.

Confining Zone – The overall confining strata above the injection zone consists of impermeable Green River calcareous shales and continuous beds of microcrystalline dolostone. The confining zone in the Ute Tribal 31-04 is 223 feet thick.

Attachment No. 3 is a structure map of the A-Marker surface.

Attachment No. 4 is a cross-section of the injection interval and confining zone.

- (6) Enclosed as Attachment No. 5 are standard analyses of produced water from three batteries that currently serve as central handling facilities for all project producing wells. The analysis of the Green River formation water from the Ute Tribal 18-08 Satellite Battery is 12805 mg/L of total dissolved solids (TDS), Ute Tribal 21-11 Satellite Battery is 15659 mg/L TDS, and Ute Tribal 34-12-D3 Satellite Battery is 14590 mg/L TDS.

Injectate in the field is a mixture of produced water and fresh make-up water. The nearest injection well is the Ute Tribal 19-13, the most recent analysis of the water being injected into the Green River formation at this location is 7342 mg/L TDS. This analysis is also included in Attachment No. 5.

- (7) A summary of completion data from the Ute Tribal 31-04 and offset wells in the AOR are included in Attachment No. 6
- (8) The cement bond log is included in Attachment No. 7.
- (9) The open hole log for the Ute Tribal 31-04 is included in Attachment No. 8.

(10) The Antelope Creek Field is operated under a Cooperative Plan of Development between the Ute Tribe and Petroglyph Energy. At the Ute Tribal 31-04 location, all mineral owners, surface owners and operators located within the AOR ¼ mile radius have been notified of the submitted EPA application to convert to injection. Attachment No. 9 is the Affidavit of Notification to all owners.

(11) Petroglyph requests a maximum surface injection pressure of **1705psi**. The EPA Area Permit No. UT20736-00000 uses the formula:

$$P_m = (0.88\text{psi/ft} - 0.43\text{psi/ft}(S_g)) D$$

Where:

P_m = Maximum surface injection pressure

0.88psi/ft = Fracture gradient

D = Top perforation depth

0.43psi/ft = Hydrostatic pressure/hydraulic head

S_g = Specific gravity of injection fluid

For the Ute Tribal 31-04:

$$\mathbf{1705\text{psi} = (0.88\text{psi/ft} - 0.43(1.00)) 3789\text{ft}}$$

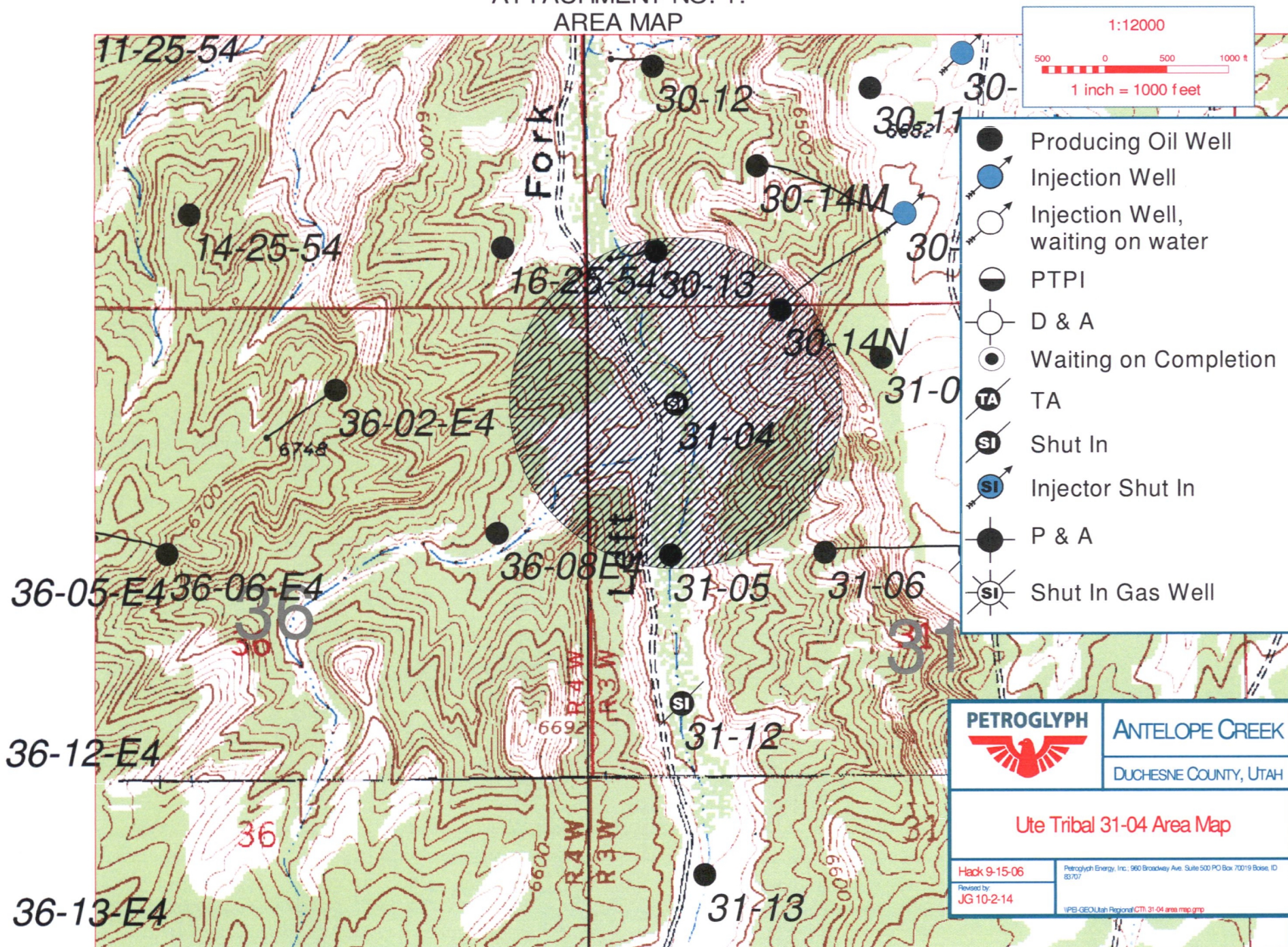
(12) Three wellbore diagrams for the Ute Tribal 31-04 are in Attachment No. 10. One diagram is for production, one for injection, and one for Plug & Abandonment (P&A).

(13) The P&A procedure for this well is shown in Attachment No. 11.

(14) Once the draft permit is issued, Petroglyph will conduct a Mechanical Integrity Test and a static bottom-hole pressure test. The MIT procedure is contained in Attachment No. 12. The conversion work will be satisfactorily completed and submitted to the EPA on Form 7520-12. A wellbore schematic will be included with this form.

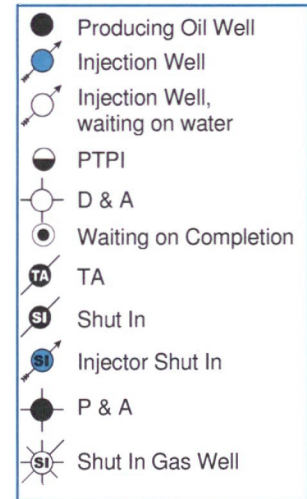
- (15) Petroglyph will give proof of financial responsibility by posting a surety bond for the UIC well prior to final permit approval. A copy of this letter is contained in Attachment No. 13.
- (16) Petroglyph will install various gauges on the well so that the injection pressure and tubing/casing annulus pressure can be monitored. The well will be equipped with a flow meter with a cumulative volume recorder.

ATTACHMENT NO. 1:
AREA MAP



The map displays a complex network of contour lines and spot elevations. Key features include:

- Contour Lines:** Labeled with values such as 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.
- Spot Elevations:** Numerous points are marked with elevations ranging from 1 to 100.
- Labels:** Various alphanumeric labels are scattered across the map, including '1-23-54', '2-24-54', '8-24-54', '10-24-54', '16-23-54', '25-2', '8-25-54', '11-25-54', '14-25-54', '16-25-54', '36-02-E4', '36-05-E4', '36-08-E4', '36-12-E4', '36-13-E4', '1-35-54', '9-35-54', '18-13', '18-14N', '18-14O', '19-02', '19-01', '19-04', '19-03', '19-05', '19-06', '19-07', '19-08', '19-09', '19-10', '19-11', '19-12', '19-13', '19-14', '19-15', '19-16', '19-17', '19-18', '19-19', '19-20', '19-21', '19-22', '19-23', '19-24', '19-25', '19-26', '19-27', '19-28', '19-29', '19-30', '19-31', '19-32', '19-33', '19-34', '19-35', '19-36', '19-37', '19-38', '19-39', '19-40', '19-41', '19-42', '19-43', '19-44', '19-45', '19-46', '19-47', '19-48', '19-49', '19-50', '19-51', '19-52', '19-53', '19-54', '19-55', '19-56', '19-57', '19-58', '19-59', '19-60', '19-61', '19-62', '19-63', '19-64', '19-65', '19-66', '19-67', '19-68', '19-69', '19-70', '19-71', '19-72', '19-73', '19-74', '19-75', '19-76', '19-77', '19-78', '19-79', '19-80', '19-81', '19-82', '19-83', '19-84', '19-85', '19-86', '19-87', '19-88', '19-89', '19-90', '19-91', '19-92', '19-93', '19-94', '19-95', '19-96', '19-97', '19-98', '19-99', '19-100', '20-01', '20-02', '20-03', '20-04', '20-05', '20-06', '20-07', '20-08', '20-09', '20-10', '20-11', '20-12', '20-13', '20-14', '20-15', '20-16', '20-17', '20-18', '20-19', '20-20', '20-21', '20-22', '20-23', '20-24', '20-25', '20-26', '20-27', '20-28', '20-29', '20-30', '20-31', '20-32', '20-33', '20-34', '20-35', '20-36', '20-37', '20-38', '20-39', '20-40', '20-41', '20-42', '20-43', '20-44', '20-45', '20-46', '20-47', '20-48', '20-49', '20-50', '20-51', '20-52', '20-53', '20-54', '20-55', '20-56', '20-57', '20-58', '20-59', '20-60', '20-61', '20-62', '20-63', '20-64', '20-65', '20-66', '20-67', '20-68', '20-69', '20-70', '20-71', '20-72', '20-73', '20-74', '20-75', '20-76', '20-77', '20-78', '20-79', '20-80', '20-81', '20-82', '20-83', '20-84', '20-85', '20-86', '20-87', '20-88', '20-89', '20-90', '20-91', '20-92', '20-93', '20-94', '20-95', '20-96', '20-97', '20-98', '20-99', '20-100', '21-01', '21-02', '21-03', '21-04', '21-05', '21-06', '21-07', '21-08', '21-09', '21-10', '21-11', '21-12', '21-13', '21-14', '21-15', '21-16', '21-17', '21-18', '21-19', '21-20', '21-21', '21-22', '21-23', '21-24', '21-25', '21-26', '21-27', '21-28', '21-29', '21-30', '21-31', '21-32', '21-33', '21-34', '21-35', '21-36', '21-37', '21-38', '21-39', '21-40', '21-41', '21-42', '21-43', '21-44', '21-45', '21-46', '21-47', '21-48', '21-49', '21-50', '21-51', '21-52', '21-53', '21-54', '21-55', '21-56', '21-57', '21-58', '21-59', '21-60', '21-61', '21-62', '21-63', '21-64', '21-65', '21-66', '21-67', '21-68', '21-69', '21-70', '21-71', '21-72', '21-73', '21-74', '21-75', '21-76', '21-77', '21-78', '21-79', '21-80', '21-81', '21-82', '21-83', '21-84', '21-85', '21-86', '21-87', '21-88', '21-89', '21-90', '21-91', '21-92', '21-93', '21-94', '21-95', '21-96', '21-97', '21-98', '21-99', '21-100', '22-01', '22-02', '22-03', '22-04', '22-05', '22-06', '22-07', '22-08', '22-09', '22-10', '22-11', '22-12', '22-13', '22-14', '22-15', '22-16', '22-17', '22-18', '22-19', '22-20', '22-21', '22-22', '22-23', '22-24', '22-25', '22-26', '22-27', '22-28', '22-29', '22-30', '22-31', '22-32', '22-33', '22-34', '22-35', '22-36', '22-37', '22-38', '22-39', '22-40', '22-41', '22-42', '22-43', '22-44', '22-45', '22-46', '22-47', '22-48', '22-49', '22-50', '22-51', '22-52', '22-53', '22-54', '22-55', '22-56', '22-57', '22-58', '22-59', '22-60', '22-61', '22-62', '22-63', '22-64', '22-65', '22-66', '22-67', '22-68', '22-69', '22-70', '22-71', '22-72', '22-73', '22-74', '22-75', '22-76', '22-77', '22-78', '22-79', '22-80', '22-81', '22-82', '22-83', '22-84', '22-85', '22-86', '22-87', '22-88', '22-89', '22-90', '22-91', '22-92', '22-93', '22-94', '22-95', '22-96', '22-97', '22-98', '22-99', '22-100', '23-01', '23-02', '23-03', '23-04', '23-05', '23-06', '23-07', '23-08', '23-09', '23-10', '23-11', '23-12', '23-13', '23-14', '23-15', '23-16', '23-17', '23-18', '23-19', '23-20', '23-21', '23-22', '23-23', '23-24', '23-25', '23-26', '23-27', '23-28', '23-29', '23-30', '23-31', '23-32', '23-33', '23-34', '23-35', '23-36', '23-37', '23-38', '23-39', '23-40', '23-41', '23-42', '23-43', '23-44', '23-45', '23-46', '23-47', '23-48', '23-49', '23-50', '23-51', '23-52', '23-53', '23-54', '23-55', '23-56', '23-57', '23-58', '23-59', '23-60', '23-61', '23-62', '23-63', '23-64', '23-65', '23-66', '23-67', '23-68', '23-69', '23-70', '23-71', '23-72', '23-73', '23-74', '23-75', '23-76', '23-77', '23-78', '23-79', '23-80', '23-81', '23-82', '23-83', '23-84', '23-85', '23-86', '23-87', '23-88', '23-89', '2



Structural Cross Section A to A' in the Vicinity of Ute Tribal 31-04

43013319650000 5467 ft 43013319700000 4624 ft 43013320340000 1211 ft 43013320350000 2548 ft 43013320390000

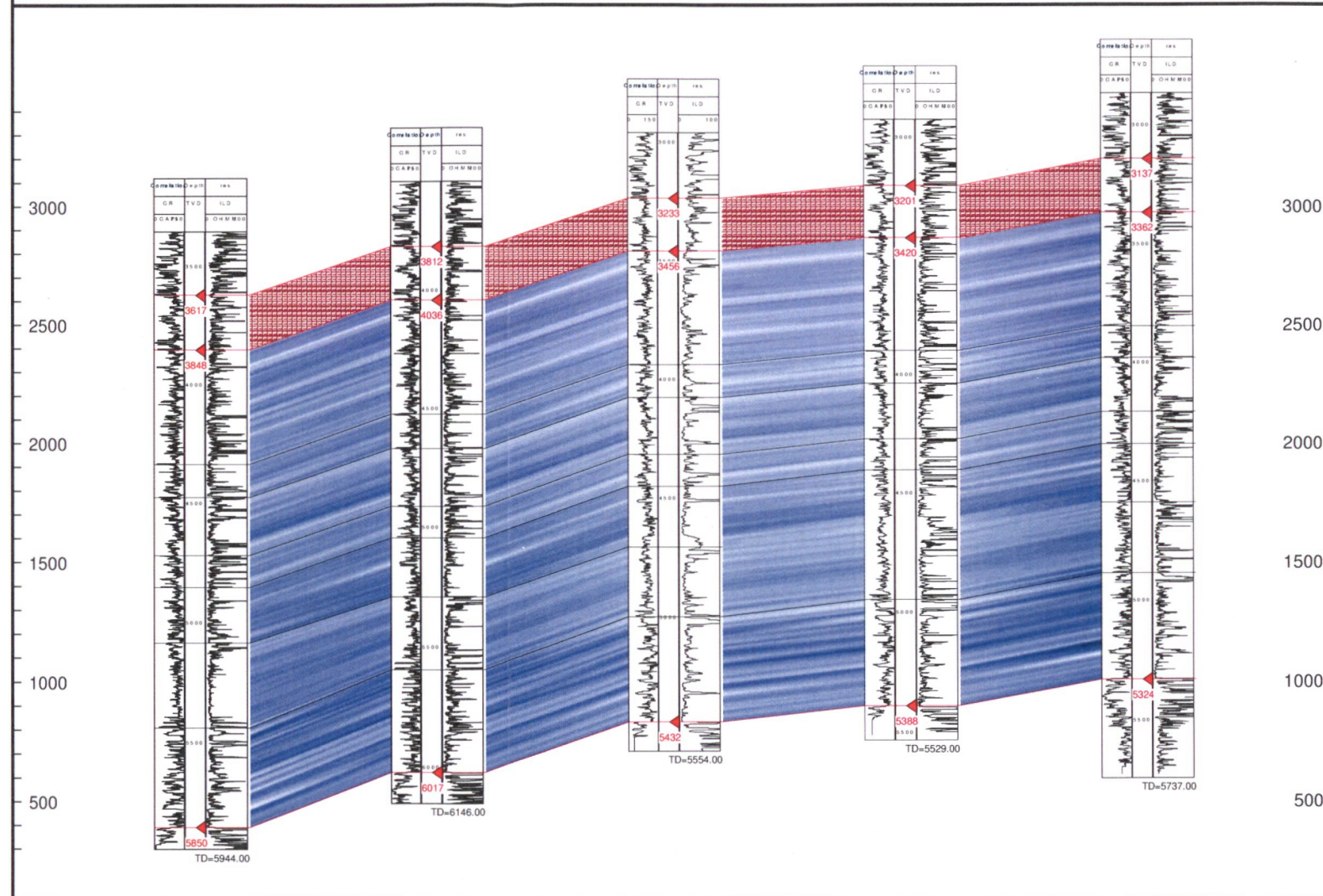
PETROGLYPH OPERATING COMPANY INC Ute Tribal 19-07 1661 FNL 2013 FWL TWP: 5 S - Range: 3 W - Sec. 1

PETROGLYPH OPERATING COMPANY INC Ute Tribal 30-06 1802 FNL 2500 FWL TWP: 5 S - Range: 3 W - Sec. 30

PETROGLYPH OPERATING COMPANY INC Ute Tribal 31-04 770 FNL 703 FWL TWP: 5 S - Range: 3 W - Sec. 31

PETROGLYPH OPERATING COMPANY INC Ute Tribal 31-05 1980 FNL 660 FWL TWP: 5 S - Range: 3 W - Sec. 31

PETROGLYPH OPERATING COMPANY INC Ute Tribal 31-13 644 FSL 929 FWL TWP: 5 S - Range: 3 W - Sec. 31



Ute Tribal 31-04 Well History

Well History:

Spud Well: 3/5/1998

Completed: 4/7/1998

First Production: 4/14/1998

Tops (KB):

BMSW* Found at 1264'

Green River 982'

A Marker 3456'

X Marker 3934'

Douglas Creek 4072'

B Limestone 4447'

Castle Peak 4945'

Basal Carbonate 5432'

Perf History

3/31/1998

B08.2	3800' to 3804'
C02	4013' to 4017'
C04	4108' to 4112'
C06	4267' to 4271'
C09.2	4397' to 4401'
D3	4506' to 4510'
E07	5310' to 5314'

GL: 6254'

KB: 6264'

8 5/8" 24# Surface CSG @ 355' KB

cmt'd w/300 sx

Surface Hole size 12 1/4"

Cement top @ 170'

5 1/2" 15.5# J-55 CSG @ 5517'

cmt'd w/565sx

Hole Size 7 7/8" bit

Perf's:

B08.2 3800' to 3804'

C02 4013' to 4017'

C04 4108' to 4112'

C06 4267' to 4271'

C09.2 4397' to 4401'

D3 4506' to 4510'

E07 5310' to 5314'

Petroglyph Operating Co., Inc.

Ute Tribal #31-04

(770' FNL & 703' FWL)

NW NW Section 31, 5S- 3W

Antelope Creek Field

Duchesne Co. Utah

API#: 43013320340000

*Plate 1 Utah Geological Survey Special Study 144.
(2012). BMSW Elevation Contour Map, Uinta Basin,
Utah. [map]. (CA 1:200,000)

PBTD @ 5442' KB

TD @ 5554' KB

(Not to Scale)

Ute Tribal 31-04 Injection

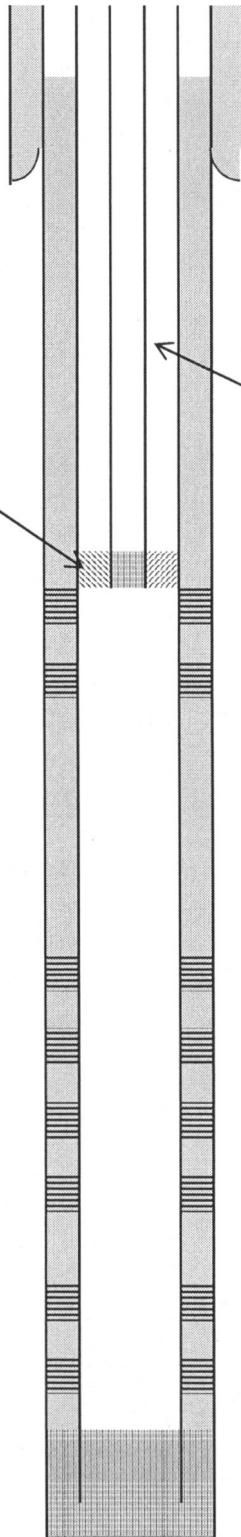
Well History:

Spud Well: 3/5/1998
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Tops (KB):

BMSW* Found at 1264'
Green River 982'
A Marker 3456'
X Marker 3934'
Douglas Creek 4072'
B Limestone 4447'
Castle Peak 4945'
Basal Carbonate 5432'

Injection packer @ 3700'



GL: 6254'

KB: 6264'

8 5/8" 24# Surface CSG @ 355' KB
cmt'd w/300 sx

Surface Hole size 12 1/4"

Cement top @ 170'

5 1/2" 15.5# J-55 CSG @ 5517'
cmt'd w/565sx

Tubing 2 7/8" 6.5# J55

Hole Size 7 7/8" bit

Perf's:

Add B08.2 3789' to 3792'
B08.2 3800' to 3804'
Add B08.2 3804' to 3808'
Add B10 3846' to 3850' and 3860' to 3863'
C02 4013' to 4017'
Add C04 4105' to 4108'
C04 4108' to 4112'
Add C04 4112' to 4115'
Add C05 4132' to 4135'
Add C06 4262' to 4267'
C06 4267' to 4271'
Add C09.2 4393' to 4397'
C09.2 4397' to 4401'
Add C09.2 4401' to 4403'
D3 4506' to 4510'
Add D3 4510' to 4513'
Add D7 4664' to 4669'
Add E01.1 5001' to 5022'
Add E07 5308' to 5310'
E07 5310' to 5314'
Add E07 5314' to 5316'

PBTD @ 5442' KB

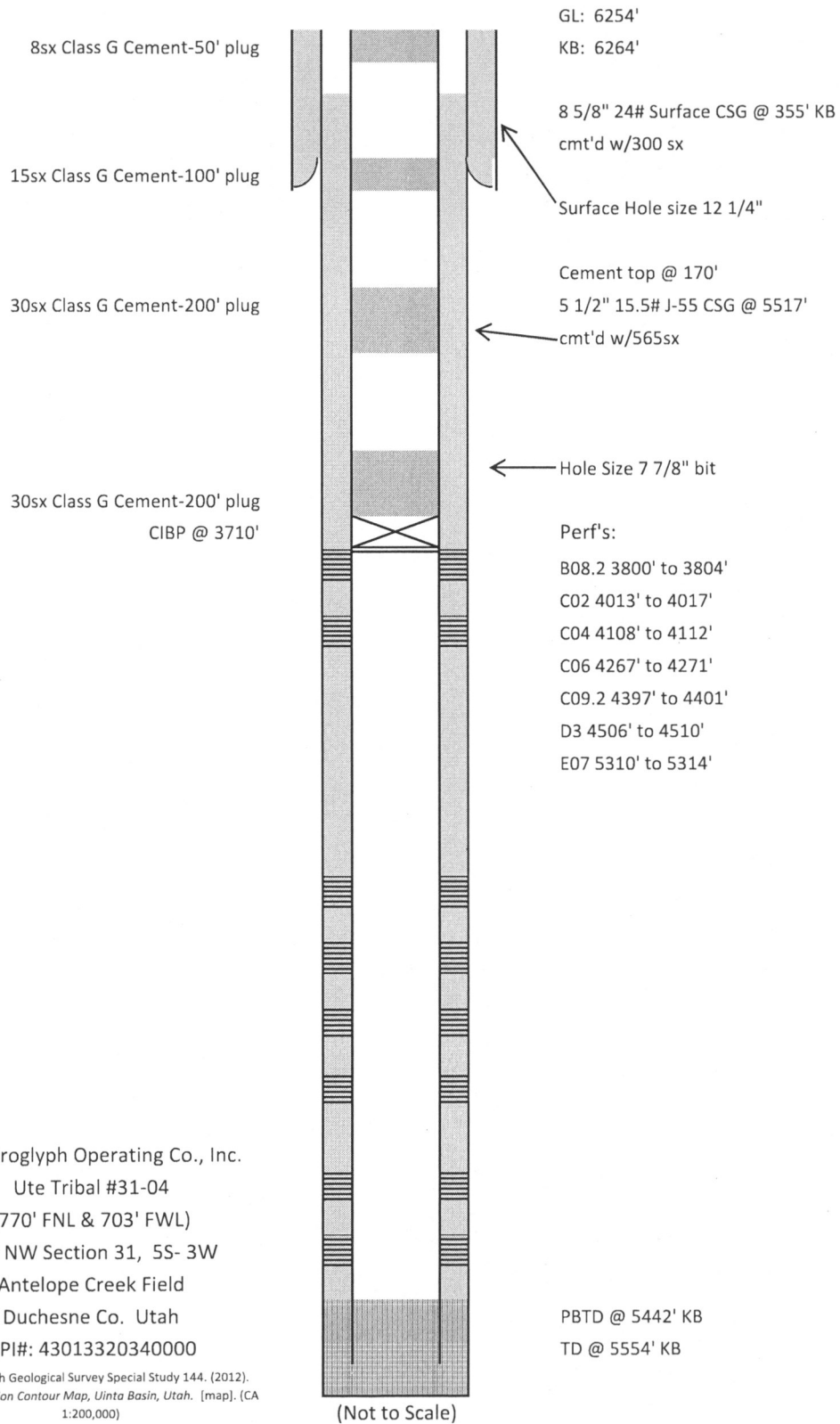
TD @ 5554' KB

Petroglyph Operating Co., Inc.
Ute Tribal #31-04
(770' FNL & 703' FWL)
NW NW Section 31, 5S- 3W
Antelope Creek Field
Duchesne Co. Utah
API#: 43013320340000

*Plate 1 Utah Geological Survey Special Study 144.
(2012). BMSW Elevation Contour Map, Uinta Basin,
Utah. [map]. (CA 1:200,000)

(Not to Scale)

Ute Tribal 31-04 Plug and Abandonment



*Plate 1 Utah Geological Survey Special Study 144. (2012).
BMSW Elevation Contour Map, Uinta Basin, Utah. [map]. (CA
1:200,000)

Cement Bond Index (in millivolts - mV)

Date: September 2, 2015

Operator: Petroglyph

Well: Ute Tribal 31-04

Permit :

Enter the following values:

Amplitude at 0% Bond (A-0) (in mV) = 60 mV

Amplitude at 100% Bond (A-100) (in mV) = 1 mV

Amplitude at 80% Bond (A-80) = 2.3 mV

$[(0.2)\log A_0 + (0.8)\log A_{100}]$

Amplitude at 90% Bond (A-90)= 1.5 mV

$[(0.1)\log A_0 + (0.9)\log A_{100}]$

Amplitude at 70% Bond (A-70)= 3.4 mV

$[(0.3)\log A_0 + (0.7)\log A_{100}]$

Amplitude at 60% Bond (A-60)= 5.1 mV

$[(0.4)\log A_0 + (0.6)\log A_{100}]$

Maximum Allowable Injection Pressure (MAIP)
From Fracture Gradient

Date: 09/02/2015 Operator: Petroglyph
Well: Ute Tribal 31-04
Permit #: _____

Enter the following values:

Specific Gravity of injectate =	<u>1.010</u>	g/cc
Depth to top of injection interval =	<u>3,456</u>	feet
Fracture Gradient (F G) =	<u>0.880</u>	psi/ft

MAIP = **1,525** psig

(rounded down to nearest 5 psig)

where:

$$MSIP = [FG - (0.433 * SG)] * \text{Depth to top of injection interval} = 1529.868$$